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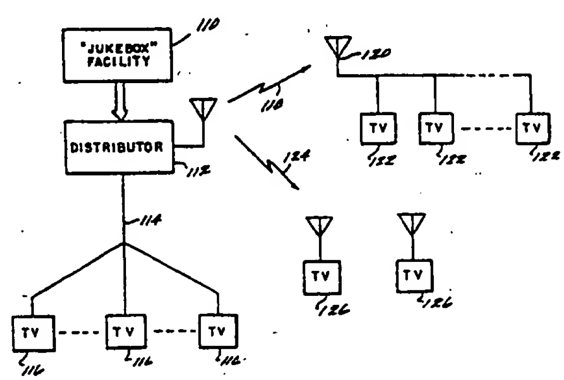
(54) **Music delivery system.**

(57) A music delivery system permitting a subscriber to select from among a plurality of available music selections, particular selections that the subscriber wishes to hear at any time. The plurality of music selections are "played" at a central "jukebox" facility (110). They are frequency multiplexed onto one or more communication channels (114) that are typically used to carry video information, such as a cable television channel. The video channel information is distributed to individual subscribers either via unused channels of a cable television system, by direct broadcast at commercial television frequencies, by direct satellite transmission to a subscriber, or by some other means. A subscriber uses a converter box to demultiplex and thereby select a desired musical selection for demodulation. Demodulation can take place in the subscriber's television or in some other apparatus. Music selections are selected in a similar fashion to the manner in which particular channels of a cable television system are selected for video viewing. Each music selection is on an audio sub-channel of a video channel. The music on the sub-channels is continuously played in such a way that any specific selection can be chosen at any time.



EP 0 140 593 A2

MUSIC DELIVERY SYSTEM

This invention relates in general to music delivery systems. More specifically, the invention relates to "jukebox" type systems whereby a user can select and hear a particular musical selection whenever desired. In essence, the present invention provides a system for bringing jukebox music directly to a subscriber. The subscriber can select a particular one or series of pieces of audio entertainment to be "played" in the subscriber's home at any time.

The traditional jukebox is a unit including a plurality of records. A user can select, by the manipulation of switches, a particular record to be played. That record is played and all those within earshot of the jukebox speakers listen to the record which has been selected. An improved version of the traditional jukebox can be found in many restaurants. A separate selector box and speaker are placed at each table in the restaurant. The jukebox is wired to each selector box so that a record can be selected by a patron at any table. Of course, only one record at a time is played and the music is delivered directly to the speaker at the table.

A music lover is able to bring into the home particular audio entertainment that he or she wishes to hear by buying records and playing them on a home high-fidelity stereo system. Unfortunately this requires buying each record to be played. This can get quite expensive. An alternative is for the music lover to listen to

the radio. The problem with this is that one can only listen to the particular music selected by the disc jockey. There is no way to hear particular songs when the listener wishes to hear them without buying a record or a cassette tape.

The present invention provides a method for delivering music comprising the steps of:

generating a frequency multiplexed composite electrical signal corresponding to a plurality of pieces of audio information;

transmitting the composite signal to a subscriber;

demultiplexing a particular one of said plurality of pieces of audio information; and

transducing the particular desired piece of audio information into an audio signal.

Such a method may include separately the steps of generating electrical signals corresponding to a plurality of different pieces of audio information and frequency multiplexing the signals to form said composite signal.

Preferably, said step of generating comprises the step of generating electrical signals from pre-recorded records.

More preferably, said step of generating comprises the step of generating electrical signals by

playing a pre-recorded optical-type record using a laser playback device.

Preferably, said step of transmitting comprises the step of transmitting the composite signal over a cable, particularly a coaxial cable.

Preferably, said step of demultiplexing comprises the steps of:

selectively frequency converting a portion of said composite signal corresponding to said particular desired piece of audio information to a predetermined intermediate frequency; and

demodulating at said intermediate frequency to provide said particular desired audio information at baseband.

Preferably, said step of demodulating comprises the step of demodulating using an audio IF train of a television receiver.

In another aspect the invention provides an arrangement for delivering music to a subscriber comprising:

means for generating a frequency multiplexed composite electrical signal corresponding to said plurality of pieces of audio information;

means for transmitting the composite signal to a subscriber;

means for demultiplexing a particular one of said plurality of pieces of audio information; and

means for transducing the particular desired piece of audio information into an audio signal.

Preferably, the various means for carrying out functions just described operate in the preferred manners described above.

The invention further provides an audio sub-channel converter for selecting a particular one of a plurality of audio sub-channels of a video channel comprising:

means for receiving said video channel from a cable;

means for synthesizing a local oscillator signal the frequency of which can be user controlled;

means for mixing said synthesized signal with said input signal to provide a desired sub-channel on a predetermined intermediate frequency;

means for FM modulating said selected audio sub-channel onto a carrier predetermined frequency;

means for generating an output channel video carrier oscillation; and

means for mixing said predetermined frequency FM modulated with said audio sub-channel onto said video carrier frequency for transmission to a television.

Preferably, said converter further comprises means for FM detecting said intermediate frequency signal for detecting start and stop tones on said audio sub-channel; and

means for controlling said local oscillator frequency responsive to said start and stop tones.

Preferably said converter further comprises means for muting audio output of said television when there is not audio information on a selected sub-channel.

In another aspect the invention provides a converter for selecting a particular one of a plurality of audio sub-channels of a video channel comprising:

means for receiving an input video channel;

means for synthesizing a local oscillator frequency having a user selectable frequency for converting a desired sub-channel to a predetermined first intermediate frequency;

means for converting said first predetermined intermediate frequency to a second predetermined intermediate frequency;

means for detecting audio information at said second intermediate frequency;

means for FM modulating the detected audio onto a predetermined carrier;

means for generating a video carrier signal; and

means for FM modulating said predetermined carrier onto said video carrier for coupling to a subscriber's television.

Preferred aspects of the invention will now be

discussed in more detail without prejudice to the generality of the foregoing.

The present invention may provide a music lover with an alternative to buying and collecting records while providing the ability to select for listening any one of a plurality of selections at any time. A subscriber simply manipulates a keyboard to select a particular song or sequence of songs desired. Within about 30 seconds or less, the subscriber's first choice begins to play.

In its preferred embodiment, the music delivery system delivers music via a cable TV system already serving the subscriber. For the cable TV subscriber, it provides an active music retrieval system that allows choices from a monthly updated list of a plurality (such as 200) of music selections. These may, for example, range from top 40 hits to golden oldies to jazz to county-western to classical to gospel.

When subscribers wish to hear a musical selection, they simply refer to a monthly cable guide which lists all available songs. Each selection is numbered. The subscriber simply keys in that number on a converter box and within approximately 30 seconds, the selection begins to play.

In one embodiment, the system utilizes the sound system built into a television set. If the subscriber is satisfied with such a sound system, the selected music can simply be "played" through the television. In an alternative embodiment, music selected can be played over an existing stereo system or an optional amplifier/speaker arrangement provided as a peripheral device.

The subscriber receives music from a central library through the same cable that provides cable television service to the subscriber's home, business or other location. A significant advantage of the music delivery system according to the present invention is that it utilizes an existing cable TV system without the need to rewire countless homes.

Typically, a television cable system brings a cable to the subscriber's home. This cable carries 30 or more video information channels, each channel being about 6 MHz in bandwidth. The subscriber is provided with a converter box which selectively converts a desired channel to a particular unused video broadcast channel in the area such as, for example, channel 3. The subscriber tunes the television to channel 3 and leaves it there. As different cable video channels are desired for viewing, they are converted to channel 3. Conversion usually takes place in a converter box having a plurality of switches for selecting a desired cable channel. Most cable television systems have a number of channels which are unused or which can be made vacant for use by the music delivery system.

The music delivery system according to the present invention frequency multiplexes approximately 75 to 200 audio channels into a 6 MHz bandwidth video channel so that 75 to 200 different audio "sub-channels" can be simultaneously transmitted via a single video channel. In one embodiment, a particular audio selection is played continuously (over and over again) on a given audio sub-channel. To hear a desired selection, the particular sub-channel on which that selection plays is demultiplexed by converting it to a predetermined frequency such as, for example, the sound intermediate frequency (I.F.) of a television. A particular video channel of a cable system carrying the audio sub-channels can be selected on the subscriber's already existing video converter box. An additional converter box can be used to tune to the particular audio sub-channel carrying the music selection desired.

From the subscriber's point of view, the system works like an active retrieval library of approximately 200 selections. The selections can be routinely updated such as, for example, on a monthly basis or more often whenever a new "hit" occurs. The musical selections are played at a central jukebox facility using either a plurality of conventional turntables or any other type of reproduction system that can produce electrical signals from prerecorded records. In the preferred embodiment, a laser disc player or players are used to play back from optically readable discs.

The heart of the laser system is a semiconductor laser that shines a beam of coherent light onto a rapidly spinning optically readable disc on which a music selection has been encoded. The laser beam "reads" the coded disc and converts it into an electrical signal.

In one embodiment, the audio signal for each different audio selection is generated by a separate audio playback unit, such as a laser disc audio playback unit. The audio signals are then multiplexed into a single video channel or a small number of video channels. With a laser disc system, a plurality of read-out beams can be used for each record that is being continuously played. Thus, the same musical selection can be placed on a plurality of different audio sub-channels of a video channel, each sub-channel having a different "phase" with respect to the others. Thus, if a 3 minute song is played repeatedly on six different audio sub-channels with equally spaced starting times, one would never be more than a half a minute from the beginning of the musical selection desired.

The audio signals for 200 (more or less) such audio channels could be generated, as in the example above, by 200 compact audio disc playback units, each playing a different song with its own laser beam. However, in a preferred embodiment, the system will use a more practical technique which uses only one playback unit. As many as 200 audio channels could be recorded, with specially designed recording equipment, on a single video-type laser disc because it has the full bandwidth of a video channel. This disc could then be played back at the cable head with a playback unit

similar to conventional video disc playback units. All of the audio channels recorded on the disc could then be played back by a single laser beam and can be transmited through a single video cable channel simultaneously. All of the audio channels would thus be available at the subscriber's location at the same time.

The preferred embodiment will be a laser video disc system; but instead of just one laser "reading" each disc, a plurality of such lasers will be employed, so that if the average song lasts three minutes and six lasers are used, the beginning of any given song will never be more than approximately 30 seconds away. From one disc containing 200 musical selections, six lasers could be used to generate signals for 1200 audio channels. Each of the 200 musical selections would be carried on six of these 1200 channels but with starts at 30-second intervals. By transmitting the 1200 audio channels, which are equivalent to six video channels, through six channels of the cable, the system would have the capability of delivering <u>any</u> of the 200 selections -- from the beginning of the selection, within approximately 30 seconds -- to the system in the subscriber's home. Start and stop signals can be incorporated into the system so that the user's musical choice automatically switches to the audio sub-channel carrying the next beginning of the selection desired.

The subscriber's audio converter box could include a microprocessor based system having a memory so that one could program a sequence of desired musical selections, including repeat plays of a single song or a variety of songs in a

predetermined order. The converter box would respond to the microprocessor based system by tuning to each particular appropriate audio sub-channel in the order programmed by the user.

One video cable channel having a bandwidth of 6 MHz can contain a number of different audio sub-channels, the number being a function of the signal format used for the audio information. If each sub-channel is of the standard TV FM sound signal format, 75 different sub-channels can be formed in each video channel. It is possible to increase the number of audio sub-channels if a different signal format is used. Any different signal format requires that the selected sub-channel signal be demodulated with the resulting audio being impressed onto an FM carrier with the standard TV FM sound signal format so that it can be demodulated in the user's television if the television is to be used as the playback instrument.

In addition to the TV FM sound signal format, there are several signal formats that can be used, each of which has its own advantages and disadvantages. With some there is a slight degredation in audio quality either through a decrease in the maximum audio frequency that can be transmitted or in poorer signal to noise performance or both. With appropriate selection of signal format, it is possible to obtain about 200 audio sub-channels for each video channel. For 200 audio sub-channels, the total signal width (audio information) plus some guard band to protect against mutual interference must be no more than 30 kHz.

One alternative format is that of an FM signal with limited high frequency audio response. Using a modulation index of 1.67 (the same as that for the standard TV FM signal) and constraining the signal width to 30 kHz, a maximum audio frequency of 5600 Hz can be used. This corresponds roughly to AM broadcast quality and may be considered too low a fidelity.

A second possible audio sub-channel format is simple amplitude modulation. With a bandwidth of 30 kHz, a maximum audio frequency of 15 kHz is theoretically possible, but because of the absence of capture effect enjoyed by FM systems, which reduces adjacent channel interference, a maximum audio frequency of less than 15 kHz, but not less than 12 kHz, is more realistic. This quality is not far from that of TV FM sound. Besides somewhat reduced high frequency audio response, some increase in noise and signal distortion can be expected.

Of these two formats, the second, the AM system, is presently conceived as being preferable.

The subscriber is provided with an audio sub-channel converter which can be provided either as part of the home subscriber's video converter box supplied by the cable television operator or as a separate unit. A separate unit is presently conceived as being the most desirable arrangement. Advantage may be taken of the fact that, in most cable systems, the channel selected by the subscriber's video converter box is converted to channel 3. The subscriber's television set remains tuned to channel 3 at all times. The additional converter box for the jukebox system

could be designed for installation between the television and an existing video cable converter box supplied by the subscriber's cable television operator. The desired video channel (carrying many audio sub-channels) is selected on the existing video converter box, with the desired musical selections then being selected by the additional audio sub-channel converter. Only one design would thus be necessary for the audio sub-channel converter, a decided economic advantage.

The "jukebox" concept claimed herein is not limited to cable television systems. Rather, it is applicable to any system by which a traditional "video" channel of approximately 6 MHz bandwidth can be delivered to a subscriber. For example, some subscribers now receive television pictures by direct transmission from a satellite which transmits hundreds of video channels. One or more of such channels could be dedicated for "jukebox" service. An earth satellite receiver from which a subscriber obtains video entertainment could be fitted with an audio sub-channel converter box so that jukebox selections can be transmitted to the subscriber via the same satellite-to-earth link.

Some television subscribers now receive pay television transmissions from a traditional broadcast station. These transmissions are scrambled and the subscriber is given a decoding box to unscramble the transmission before it is coupled to the subscriber's television. In a similar fashion, a video channel filled with audio sub-channel music selections could be scrambled and broadcast over the air in the same manner that commercial television is broadcast. Subscribers

could be given appropriate decoding apparatus and converter boxes so that they could select the desired music selections transmitted "over the air".

Applicants' invention includes both a method of delivering entertainment and various apparatuses for providing subscriber jukebox service. In effect, applicants' inventive method comprises the steps of: generating electrical signals corresponding to a plurality of different pieces of audio information; frequency multiplexing the signals to form a composite signal corresponding to said plurality of pieces of audio information; transmitting the composite signal to a subscriber; demultiplexing a particular one of said plurality of pieces of audio information; and transducing the particular desired piece of audio information into an audio signal.

The generating step could include playing records in the traditional manner, using one or more laser beams to read an optically readable audio disc containing a musical selection, playing cassette tapes, or some other technique. The frequency multiplexing could include the multiplexing onto traditional cable television frequencies, earth satellite transmission frequencies, commercial television broadcast frequencies, or other such arrangements. The transmitting step could include the transmission of frequency multiplexed signals over cables, over the airwaves, etc. The demultiplexing would be provided by an audio sub-channel converter box so that the subscriber could select particular sub-channels to be demultiplexed and demodulated. The transducing could be through the television's

audio system, the subscriber's stereo, or other devices suitable for this purpose.

For the traditional television audio FM format, there is provided a converter box for selecting a particular audio sub-channel including: means for receiving a video channel input from a cable; means for generating a synthesized local oscillator having a user controllable frequency; means for mixing the cable input with the synthesized local oscillator to produce an intermediate frequency singal containing the desired music selection; an output channel video carrier oscillator; and means for impressing the selected audio signal onto the output channel video carrier for coupling to the subscriber's television.

For the AM signal format, there is provided a converter box including: means for synthesizing a local oscillator frequency for converting a desired audio sub-channel to a first intermediate frequency; means for converting the selected audio at the first intermediate frequency to a second intermediate frequency; means for converting the selected audio at the first intermediate frequency to a second intermediate frequency; means for demodulating the audio at said second intermediate frequency; means for modulating the demodulated audio into an FM sound signal in television format; and means for impressing

the FM modulated signal onto an output channel video carrier for coupling to a subscriber's television.

The invention will be further illustrated by the following description of preferred embodiments with reference to the accompanying drawings, in which;-

FIGURE 1 is a schematic diagram illustrating the general concept of the present invention;

FIGURE 2 is a block diagram of an audio sub-channel converter for use with a television audio signal format; and

FIGURE 3 is a block diagram of an audio sub-channel converter for use with an AM format.

General Concept

A plurality of musical selections are "played" at a central "jukebox" facility 110. Electrical signals are generated for each such selection. Facility 110 can include either a video bandwidth laser disc player or a plurality of record players, laser disc players, cassette tapes, or the like. The signals for individual music selections are transmitted to a distributor 112. Distributor 112 can be either a cable television operator, a satellite operator, a commercial broadcast operator, or the like.

If distributor 112 is a cable operator, the music selections are multiplexed onto one or more cable television channels and distributed via cable 114 to individual subscriber televisions 116. If distributor 112 is a satellite operator or commercial television broadcaster, the video channel information can be broadcast over the air as represented by arrow 118 to either a master antenna system symbolized by antenna 120, for distribution to televisions 122 or broadcast directly to individual TV subscribers as symbolized by arrow 124 and televisions 126.

Constraints of Television Receiver

The sound channels of modern television receivers accept a frequency modulated (FM) signal having a peak carrier deviation of ± 25 kHz. Audio frequency response is 50 Hz to 15 kHz with a high frequency deemphasis time constant network of 75 μs being used to equalize noise performance between high and low audio frequencies. FM signal amplification and detection are done at an IF frequency of 4.5 MHz, corresponding to the frequency difference between the frequency modulated aural carrier and the AM (vestigial side band) modulated video (picture) carrier. The TV set depends upon the presence of the visual carrier to heterodyne the aural carrier down to 4.5 MHz through the action of the mixer stage in the TV set. Therefore the TV set must be provided not only with an appropriate FM sound carrier on some TV channel, but with an appropriate visual carrier as well, and they must be separated by 4.5 MHz. The visual carrier need not, of course, be modulated with any picture information. It does, however, perform an additional, and in this case, desirable function of darkening the screen of the TV set, which would otherwise be illuminated by noise or snow.

Cable Channel Capabilities

The presently contemplated preferred manner for transmitting music selections to individual subscribers is via a cable television system. Other transmission schemes include the use of an "over the air" broadcast channel, direct reception of a satellite communication channel, etc. This portion of the description discusses

the constraints of a cable television system used as the transmission medium to a subscriber.

Each individual television channel used in CATV system is 6 MHz in bandwidth. Almost all of this is filled with information. The signal format and frequency assignments are the same or similar to the channels used for broadcasting but, on cable, additional channels are used. These lie in frequency bands other than those allocated for broadcasting, and, indeed, in bands occupied by other broadcasting or communication services. Because of the closed nature of the cable system, mutual interference is not ordinarily encountered if the cable system is installed and maintained to high technical standards.

One or more of these channels could be used for "jukebox" service. These would probably be channels that are vacant on a particular cable system already in place. The chosen channel should be filled with as many frequency modulated signals as is possible without mutual interference, all spaced on contiguous sub-channels.

For simplicity, each signal should have the same characteristics as that normally received on a singular basis by the subscriber's TV set. Thus, the modulating frequency range, peak carrier deviation and preemphasis time constants should be the same as for the FM audio signal in any TV broadcast. Given the peak deviation value of 25 kHz and maximum modulating frequency of 15 kHz, a minimum spacing of 80 kHz is desirable. This is based upon a common criterion that the spectrum occupied by an FM signal is approximately twice the sum of the peak carrier deviation and the highest modulating frequency. This criterion is

reflected in the choice of channel spacing for standard FM broadcasting. The calculated value of channel width is 180 kHz, and a spacing of 200 kHz is used. If 80 kHz spacing is used for the proposed service, then 75 possible music selections can be transmitted, assuming no two are alike.

The Subscriber's Converter Box for an FM System

Different signal formats require different subscriber converter box arrangements. The first such format and converter box arrangement described is for an FM system.

This discussion assumes the use of a single 6 MHz cable channel containing 75 FM signals (75 different music selections). The signals transmitted on the cable are highly accurate in frequency, i.e., having an error of only $\pm$ 1 kHz.

Referring now to FIGURE 2 there is shown a block diagram for the subscriber's converter box, referred to generally by reference numeral 200. An incoming signal from the subscriber's cable television cable first passes through a band pass filter 202 to reduce out-of-channel signals and feedthrough of the converter's local oscillator to the cable system. The signal is mixed in a mixer 204 with a local oscillator signal from a synthesized local oscillator 206 and heterodyned down to 4.5 MHz. A band pass filter 208 at 4.5 MHz allows only the desired signal to pass. The bandwidth of filter 208 should be about 80-100 kHz. Oscillator 206 tunes in 80 kHz steps, and must be accurate to within $\pm$ 1 or 2 kHz. Therefore, it is preferably an indirect

synthesizer. Tuning of oscillator (206) is under control of a selection and control unit (210) responsive to user command.

The 4.5 MHz signal from filter (208) is used in two ways. It is detected, that is converted to audio, to provide start and stop tones needed by selection and control unit (210). The signal from filter (208) is amplified by an amplifier (212) which is coupled to a limiter (214). Limiter (214) is coupled to an FM detector (216) which provides the start and stop tones to selection and control unit (210). The 4.5 MHz signal is also coupled to a mixer (218) which produces as an output an unmodulated video carrier and an audio sub-channel FM modulated carrier 4.5 MHz higher in frequency.

This is the total signal needed for output to the TV set. An output channel video carrier oscillator (220) driving the mixer must be near (± 250 kHz) to the proper video carrier frequency for the channel to which the TV set is tuned.

It is desirable to suppress any audio output from the TV set when selection and control unit (210) so dictates. This will occur between music selections. There are two ways in which this can be done. In no case must the FM modulated carrier be removed, its

audio modulation must be suppressed. This may be accomplished by substituting a steady 4.5 MHz carrier, derived from a crystal oscillator (222) for the 4.5 MHz FM signal derived as described above or by detection of the FM signal, suppression of the detected audio between selections and remodulation onto a 4.5 MHz carrier. The last method is more direct,

but the first is superior from the standpoint of preventing sound distortion that could result in a detection and remodulation process. A mute control signal is provided by selection and control unit 210 to a switch 224. Switch 224 selects, responsive to the presence or absence of the mute control signal, the input to mixer 218 as either the 4.5 MHz oscillation from oscillator 222 or the 4.5 MHz signal carrying music selected from filter 208.

At the output of mixer 218 there is provided an output channel bandpass filter 226 which provides a filtered output signal from converter 200 to the subscriber's television.

If desired, the audio signal that has been demodulated can be coupled to the subscriber's stereo or other amplifier/speaker arrangement instead of being put into TV sound format to be "played" through the television.

The Subscriber's Converter Box for an AM System

Referring now to FIGURE 3 there is shown a block diagram of a subscriber converter box suitable for use with an AM signal format (presently preferred). The AM converter box is referred to generally by reference numeral 300.

Using an AM format, a total signal bandwidth of 30 kHz can provide a theoretical maximum audio frequency of 15 kHz. In practice the maximum audio frequency is somewhat degraded. Because of the absence of the capture effect enjoyed by FM systems, which reduces adjacent channel interference, a maximum audio frequency of less than 15 kHz, but probably no

less than 12 kHz is more realistic. This provides a sound quality not far from that of TV FM sound.

The converter box 300 block diagram of FIGURE 3 assumes an input from a video cable selector on television channel 3 (60-66 MHz).

Converter 300 is basically a low sensitivity AM receiver. Two frequency conversions are used to attain adequate image rejection and adjacent channel rejection. IF frequencies are chosen to be standard frequencies for which components are readily available. The muting function described in the FIGURE 2 embodiment is still used, but the muting tones are now at subaudible frequencies. The 4.5 MHz VCO (voltage controlled oscillator) may require stabilization within a small phase lock loop to meet the ± 1 kHz tolerance discussed in the FM format section of this description.

The channel 3 input signal is coupled through a channel 3 bandpass filter 302 and mixed in a mixer 304 with a signal from a synthesized local oscillator 306. The frequency of the output of oscillator 306 is controlled by a selection and control unit 308 which is responsive to user command.

As in the case of FM converter box 200, selection and control unit 308 is responsive to start and stop tones and provides a mute control signal. Mixer 304 provides a first conversion by mixing the desired music selection to 10.7 MHz (a standard IF frequency) where it is filtered by a bandpass filter 310. A second conversion is provided by mixing the output of filter 310 in a mixer 312 with a signal from an oscillator 314 operating at 11.155 MHz. This provides an output

at mixer 312 at 455 kHz which is another standard IF frequency. The 455 kHz output of mixer 312 is filtered by a filter 316 and coupled to an AM detector and muting unit 318. Selected audio from AM detector 318 is coupled to a 4.5 MHz voltage controlled oscillator 320 which provides an FM sound signal in television format. This television format FM sound signal is mixed in a mixer 322 with a signal from an output channel video carrier oscillator 324 which provides a carrier for a television channel to be tuned by the subscriber. The output of mixer 322 is filtered by an output channel bandpass filter 326 for coupling to the subscriber's television.

If desired, the audio signal that has been demodulated can be coupled to the subscriber's stereo, or optional amplifier/speaker arrangement, instead of being put into TV sound format to be "played" through the television.

Alternatives

It is possible to use more than one cable video channel, if they are available, to increase the number of music selections from which to choose. An extra channel might be used to broadcast picture information giving current information on the selections available. The attending sound would be chosen from one of the subchannels available on an adjacent 6 MHz channel and heterodyned onto the correct frequency for the sound carrier accompanying the picture.

There can be provided some means of alerting the listener's converter box that a particular selection has ended or is about to begin. This is desirable to ensure that when a

selection is made it will be played from the beginning, and when ended will not be played again if another selection has been made. One means of achieving this action is the use of two different subaudible tones, as discussed above. One, a "start" tone, would be present just before a selection, while the other, a "stop" tone, would occur in a short burst immediately after the termination of a selection. This would signal the converter box to retune to the next selection desired, or to search for whichever selection of a number of chosen selections first occurs. Since the normal range of frequencies used for television sound is 50 Hz to 15 kHz, as previously stated, the signal tones must be below 50 Hz. Another option, of course, is to use tones well above 15 kHz, an equally effective solution.

The concepts of the present invention can be applied to other delivery systems such as, for example, direct broadcast from a ground-based transmitter, satellite transmission direct to a subscriber, etc. or some combination of transmission schemes.

While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiments, it is to be understood that the invention is not to be limited to the disclosed embodiments but on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims which scope is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures.

CLAIMS

1. A method for delivering music comprising the steps of:

generating a frequency multiplexed composite electrical signal corresponding to a plurality of pieces of audio information;

transmitting the composite signal to a subscriber;

demultiplexing a particular one of said plurality of pieces of audio information; and

transducing the particular desired piece of audio information into an audio signal.

2. A method according to claim 1 wherein said step of generating comprises the step of generating electrical signals from pre-recorded records.

3. A method according to claim 2 wherein said step of generating comprises the step of generating electrical signals by playing a pre-recorded optical-type record using a laser playback device.

4. A method according to any one of claims 1 to 3 wherein said step of demultiplexing comprises the steps of:

selectively frequency converting a portion of said composite signal corresponding to said particular desired piece of audio information to a predetermined intermediate frequency; and

demodulating at said intermediate frequency to provide said particular desired audio information at baseband.

5. A method according to claim 4 wherein said step of demodulating comprises the step of demodulating using an audio IF train of a television receiver.

6. An arrangement for delivering music to a subscriber comprising:

means (110) for generating a frequency multiplexed composite electrical signal corresponding to said plurality of pieces of audio information;

means for transmitting the composite signal to a subscriber;

means for demultiplexing a particular one of said plurality of pieces of audio information; and

means (126) for transducing the particular desired piece of audio information into an audio signal.

7. An arrangement according to claim 6 wherein said generating means comprises means for generating electrical signals from prerecorded records.

8. An arrangement according to claim 7 wherein said generating means comprises means for generating electrical signals by playing a prerecorded optical-type record using a laser playback device.

9. An arrangement according to claim 6 or claim 7 wherein said demultiplexing means comprises:

means (204) for selectively frequency converting

a portion of said composite signal corresponding to said particular desired piece of audio information to a predetermined intermediate frequency; and

means for demodulating at set intermediate frequency to provide said particular desired audio information at baseband.

10. An arrangement according to claim 9, wherein said demodulating means comprises means for demodulating using an audio IF train of a television.

11. An audio sub-channel converter for selecting a particular one of a plurality of audio sub-channels of a video channel comprising:

means for receiving said video channel from a cable;

means (306) for synthesizing a local oscillator signal the frequency of which can be user controlled;

means (304) for mixing said synthesized signal with said input signal to provide a desired sub-channel on a predetermined intermediate frequency;

means (320) for FM modulating said selected audio sub-channel onto a carrier predetermined frequency;

means (324) for mixing said predetermined intermediate frequency FM modulated with said audio sub-channel onto said video carrier frequency for transmission to a television.

12. A converter according to claim 11 further

comprising means for FM detecting said intermediate frequency signal for detecting start and stop tones on said audio sub-channel; and

means for controlling said local oscillator frequency responsive to said start and stop tones.

13. A converter according to claim 11 or claim 12 further comprising means (318) for muting audio output of said television when there is not audio information on a selected sub-channel.

14. A converter for selecting a particular one of a plurality of audio sub-channels of a video channel comprising:

means for receiving an input video channel;

means (306) for synthesizing a local oscillator frequency having a user selectable frequency for converting a desired sub-channel to a predetermined first intermediate frequency;

means (312,314) for converting said first predetermined intermediate frequency to a second predetermined intermediate frequency;

means (318) for detecting audio information at said second intermediate frequency;

means (320) for FM modulating the detected audio onto a predetermined carrier;

means (324) for generating a video carrier signal; and

means (322) for FM modulating said predetermined

carrier onto said video carrier for coupling to a subscriber's television.

15. An audio sub-channel coverter for selecting a particular one of a plurality of audio sub-channels of a video channel comprising:

means for receiving said video channel from a cable;

means (206) for synthesizing a local oscillator signal the frequency of which can be user controlled;

means (204) for mixing said synthesized signal with said input signal to provide a desired sub-channel on a predetermined intermediate frequency;

an output channel video carrier oscillator (220)

means (218) for mixing said predetermined intermediate frequency signal with the output video carrier frequency for transmission to a television.

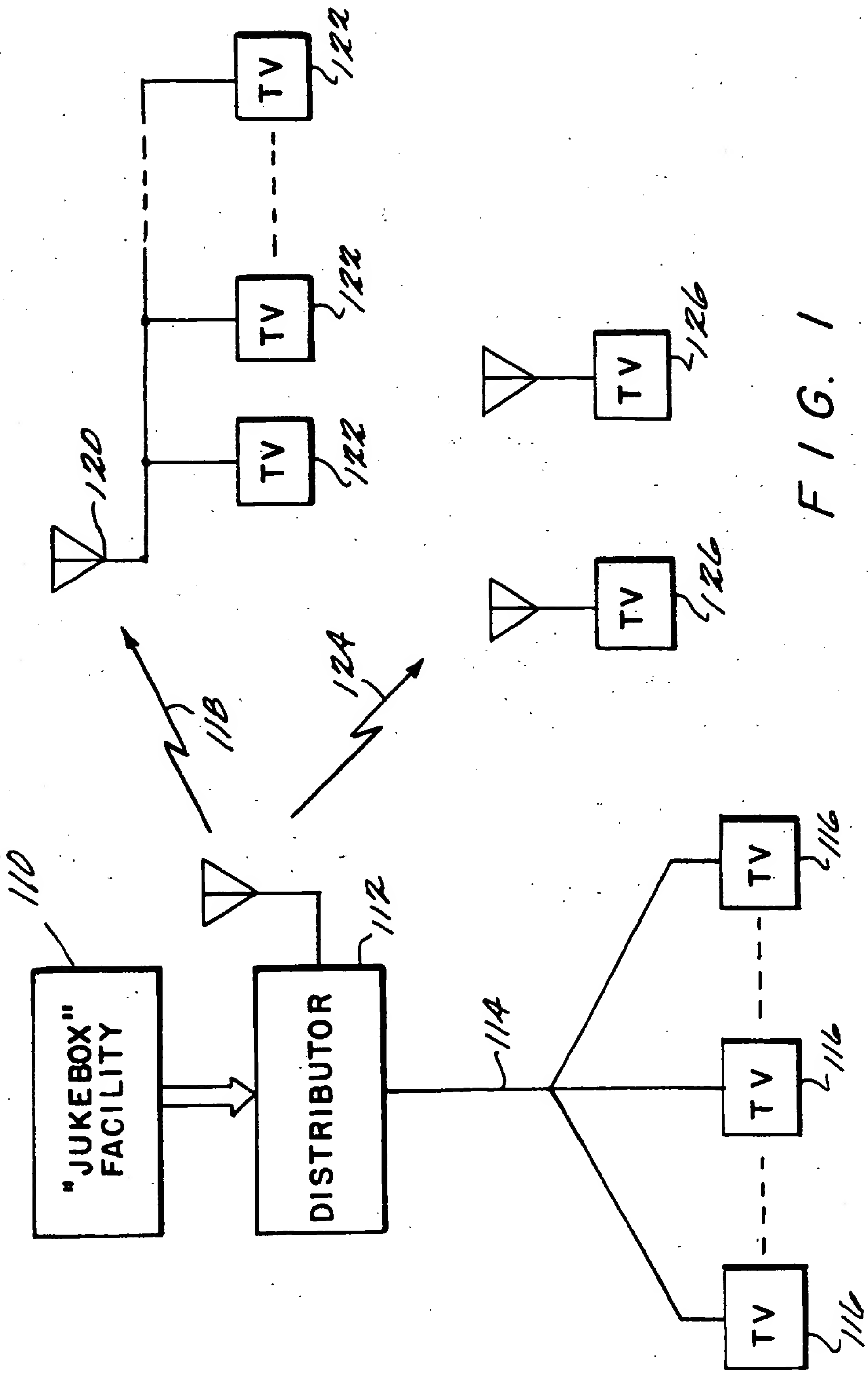

"JUKEBOX" FACILITY
110
DISTRIBUTOR
112
114
TV
116
118
124
120
122
126

FIG. 1

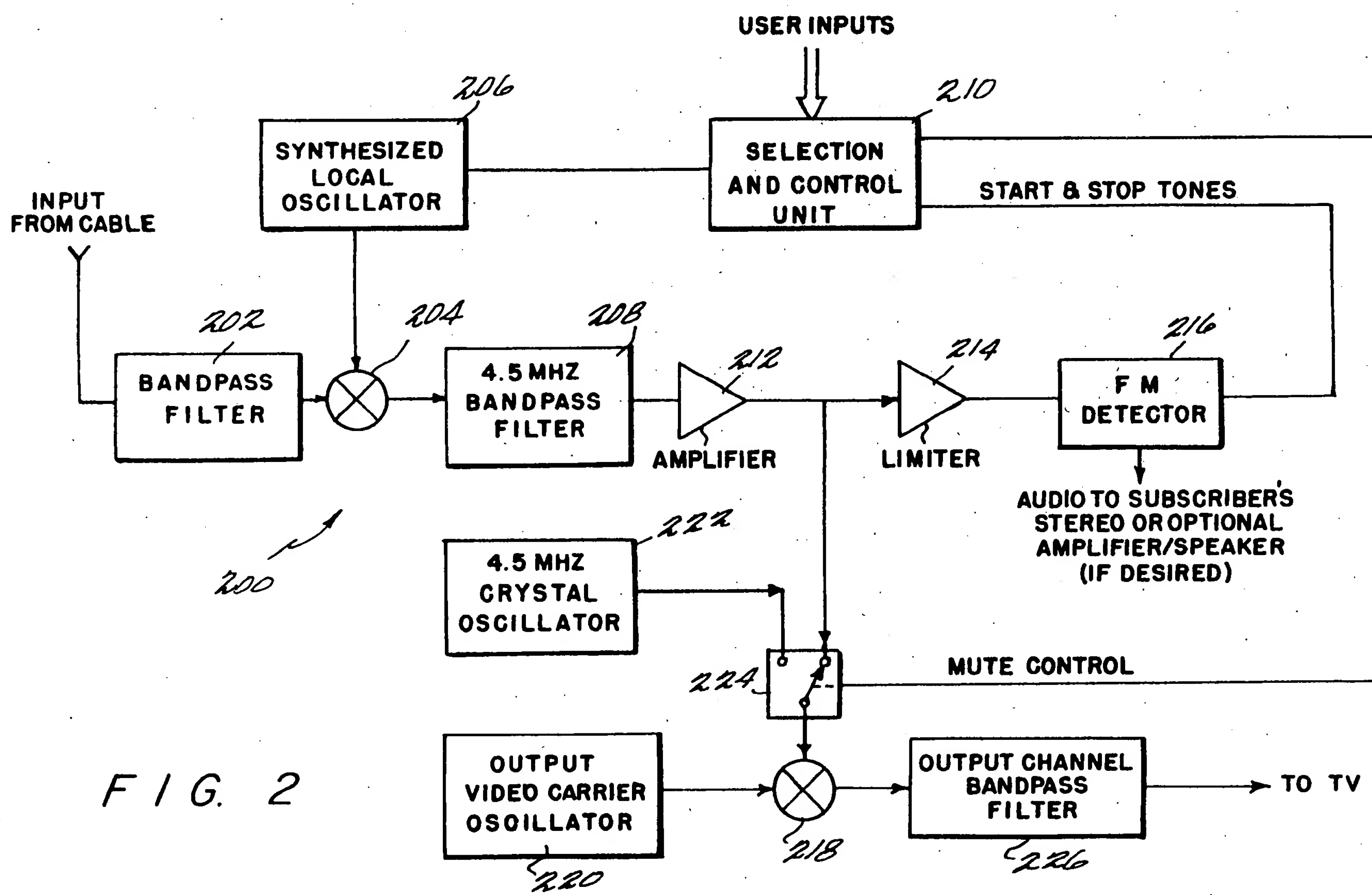
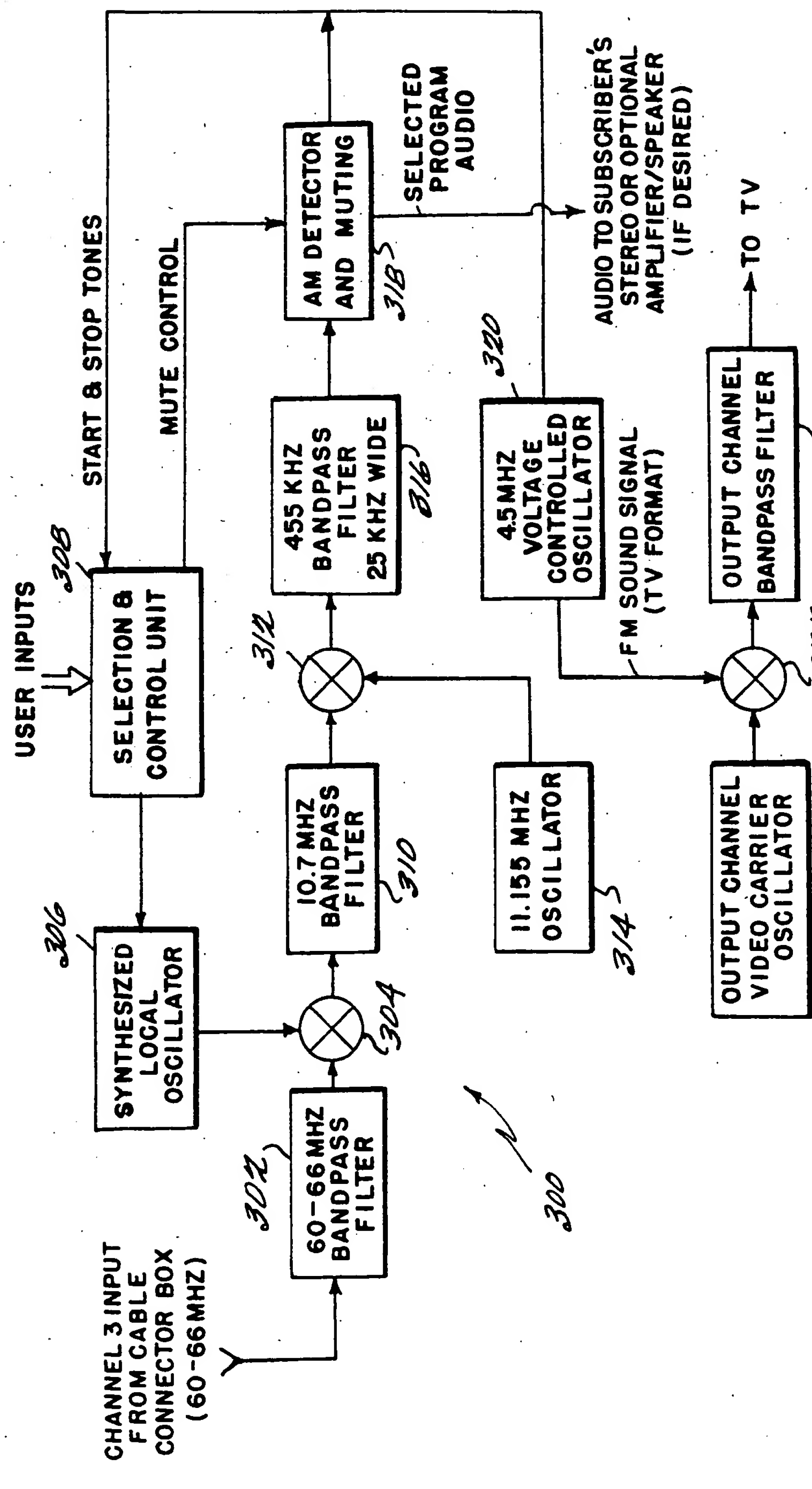

USER INPUTS
206
210
SYNTHESIZED LOCAL OSCILLATOR
SELECTION AND CONTROL UNIT
START & STOP TONES
INPUT FROM CABLE
202
204
208
212
214
216
BANDPASS FILTER
4.5 MHZ BANDPASS FILTER
F M DETECTOR
AMPLIFIER
LIMITER
AUDIO TO SUBSCRIBER'S STEREO OR OPTIONAL AMPLIFIER/SPEAKER (IF DESIRED)
200
222
4.5 MHZ CRYSTAL OSCILLATOR
224
MUTE CONTROL
OUTPUT VIDEO CARRIER OSOILLATOR
OUTPUT CHANNEL BANDPASS FILTER
TO TV
220
218
226

FIG. 2


CHANNEL 3 INPUT FROM CABLE CONNECTOR BOX (60-66 MHZ)
60-66 MHZ BANDPASS FILTER
302
304
SYNTHESIZED LOCAL OSCILLATOR
306
USER INPUTS
SELECTION & CONTROL UNIT
308
START & STOP TONES
MUTE CONTROL
10.7 MHZ BANDPASS FILTER
310
312
11.155 MHZ OSCILLATOR
314
455 KHZ BANDPASS FILTER 25 KHZ WIDE
316
AM DETECTOR AND MUTING
318
SELECTED PROGRAM AUDIO
AUDIO TO SUBSCRIBER'S STEREO OR OPTIONAL AMPLIFIER/SPEAKER (IF DESIRED)
4.5 MHZ VOLTAGE CONTROLLED OSCILLATOR
320
FM SOUND SIGNAL (TV FORMAT)
OUTPUT CHANNEL VIDEO CARRIER OSCILLATOR
324
322
OUTPUT CHANNEL BANDPASS FILTER
326
TO TV
300

F I G. 3